

THE USE OF 3D PRINTING AS A DIDACTIC TOOL IN TECHNICAL DRAWING EDUCATION WITH AN EMPHASIS ON ECODESIGN

Tetjana Tomášková, Jan Krotký, & Jarmila Honzík

Department of Mathematics, Physics and Technology, Faculty of Education, University of West Bohemia (Czech Republic)

Abstract

This article explores the use of 3D printing as a didactic tool in the teaching of technical drawing, with an emphasis on ecodesign. 3D printing offers an innovative approach to education, allowing students to better understand complex geometric shapes and constructions through interactive and tangible models. This approach not only increases the interactivity of teaching but also provides students with practical experiences that can significantly improve their spatial imagination and technical skills. The article further focuses on aspects of ecodesign and sustainability, which are crucial in modern education. The use of ecological materials for 3D printing, such as biodegradable plastics, contributes to environmental protection and supports sustainable practices. The efficient use of resources enabled by 3D printing can also reduce waste and material consumption compared to traditional production methods. Practical applications of 3D printing are illustrated with specific project examples where 3D printed models have been successfully integrated into the teaching of technical drawing. These examples include feedback from students and teachers who have utilized this technology, demonstrating how 3D printing can enrich the educational process and increase students' interest in technical fields. Technological aspects include an overview of the necessary software and hardware for 3D printing and a discussion of the challenges and solutions in its implementation in teaching. This article provides a comprehensive view of the potential of 3D printing as a tool for modern and sustainable technical drawing education, highlighting its importance for the future of technical education.

Keywords: *3D printing, didactic tool, technical drawing, ecodesign, sustainable education.*

1. Introduction

In recent years, 3D printing has become an important tool in education, especially in the field of technical drawing (Song, 2018; Pearson & Dubé, 2022; Abu Khurma, Ali & Swe Khine, 2023; Andić, Ulbrich, Dana-Picard et al., 2023). This article focuses on the use of 3D printing as a didactic tool with an emphasis on ecodesign (Bravo-Díaz & Gutiérrez-Yurrita, 2015; Neto, 2019; Bedmar, Artigas-Arnaudas, Vázquez-López, Cifuentes, Calderón-Villajos & Muñoz, 2024; Tomášková, Duda, Krotký & Honzík, 2024; Morales Méndez, del Cerro Pérez & del Cerro Velázquez, 2024; Favi & Marconi, 2025). 3D printing brings an innovative approach that allows students to better understand complex geometric shapes and structures through interactive and tangible models.

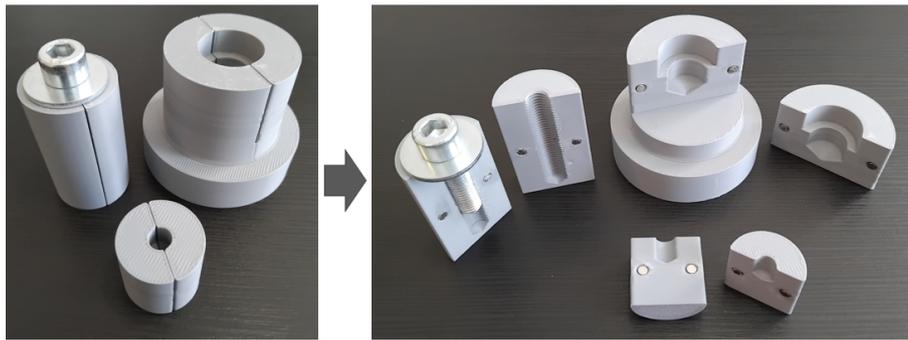
2. Didactic aids printed on a 3D printer in technical drawing education

3D printing offers an innovative approach to teaching technical drawing, allowing students to better understand complex geometric shapes and structures through interactive and tangible models. This approach not only increases the interactivity of the teaching, but also provides students with hands-on experience that can significantly improve their spatial imagination and technical skills.

2.1. Benefits of 3D printing in technical drawing teaching

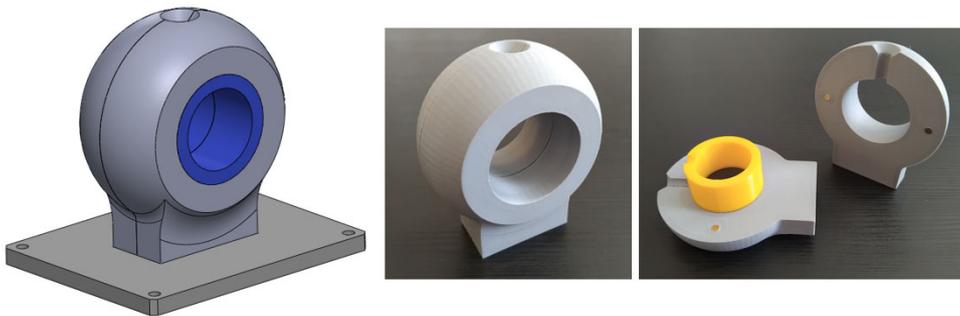
3D printed models allow students to physically manipulate objects, which increases their engagement and interest in technical drawing, for example, models of machine components can be easily created and used in teaching, see Figure 1.

Figure 1. Didactic aids printed on a 3D printer in technical drawing education.



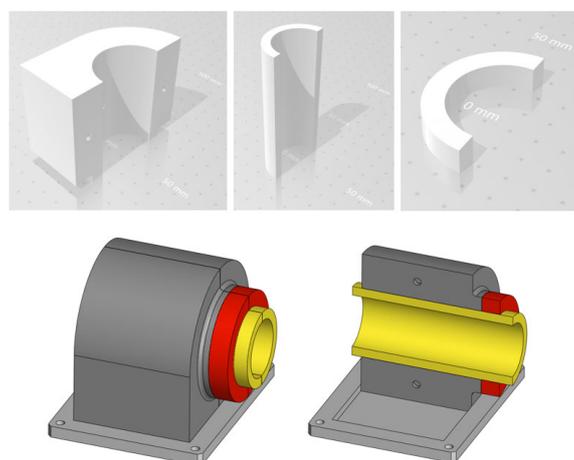
3D printing allows for the use of a variety of materials, including environmentally friendly and recyclable materials. This not only reduces costs but also promotes environmental sustainability. Students can learn about different types of materials and their properties, which is important for technical drawing and engineering. Students can gain valuable hands-on experience designing and manufacturing their own models, which they then print on a 3D printer, and this process supports creativity and technical skills that are important for future careers in engineering and technology, see Figure 2.

Figure 2. Didactic aids printed on a 3D printer (modelling in SOLIDWORKS).



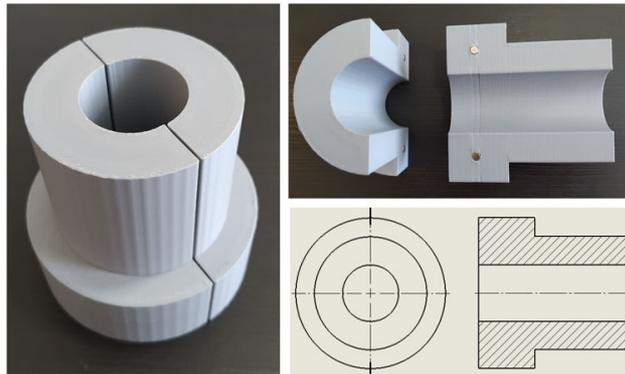
3D printed models of geometric shapes and structures can help students better understand abstract concepts and relationships between different shapes, see Figure 3.

Figure 3. Model of didactic aids (modelling in SOLIDWORKS).



Models of various machine components can be used to teach technical drawing and engineering, allowing students to study and understand their design and function in detail. Students can design and print their own technical drawings and models, providing them with hands-on experience in technical drawing and engineering processes, see Figure 4.

Figure 4. Model of didactic aid and technical drawing.



3. Conclusion

Based on simple studies and practical experience, we can conclude that without didactic aids, students achieved an average improvement in understanding and application of technical drawing of around 15%. When didactic aids printed on a 3D printer were used, students achieved an improvement in understanding and application of technical drawing by up to 35% due to the interactive and practical approach. If didactic aids are effectively integrated into the teaching and students have enough opportunities to use them, 3D printed models can significantly increase student engagement, their spatial imagination and technical skills, which leads to better learning outcomes.

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